Why Chomskyan Linguistics Is Antipsychological

Robert L. Campbell (campber@clemson.edu)
Department of Psychology; 410A Brackett Hall
Clemson University; Clemson, SC 29634-1511 USA

Abstract

The well-attested friction between linguistics and psychology is not a superficial phenomenon. No conception of language has had more influence on psychology and Cognitive Science than the linguistics of Noam Chomsky. Yet Chomskyan linguistics is radically incompatible with viable accounts of knowledge, and of the development or evolution of knowledge. This incompatibility is strongly manifested in two characteristic Chomskyan doctrines: linguistic competence and the autonomy of syntax. The fallacious arguments on which Chomsky relies are analyzed, and their deep implications for Cognitive Science are traced.

Friction between Linguistics and Psychology

No one who works in linguistics or psychology will be shocked to hear of significant friction between the two disciplines; this has been widely attested since the mid-1960s. Still, it is normally assumed that linguistics can fit under the Big Tent known as Cognitive Science just as well as psychology can. Few child language researchers would attempt to study language development without seeking to incorporate the findings of contemporary linguistics; few psycholinguists would attempt to operate without regard to categories, assumptions, and doctrines derived from linguistics.

Contrary to these impressions, I will argue that important claims made by contemporary linguistics forestall its assimilation into cognitive or developmental psychology. These are not superficial features of linguistic inquiry, lightly modifiable to assure a better fit with psychology. On the contrary, they are fundamental. They will not change unless linguistics comes to be regarded as a purely formal discipline without relevance to psychology—or linguistics is radically reoriented to assure psychological relevance.

To keep this discussion focused, I will consider only the linguistics of Noam Chomsky and his followers. American linguistics is thoroughly dominated by this school; for most contemporary cognitive psychologists, developmental psychologists, and philosophers of mind (although not for most Artificial Intelligence researchers), linguistics *is* Chomskyan linguistics. Moreover, Chomsky has consistently and persuasively insisted that psychology must pay heed to linguistic formulations, instead of operating in splendid isolation from them. Meanwhile, he has fervently resisted any suggestion that linguistics might have something to learn from psychology.

Chomsky's conception of the data that are relevant to linguistics poses difficulties; so does his conception of learning. But the antipsychological implications of Chomskyan theory and practice are largely traceable to two assumptions: the doctrine of linguistic competence and the doctrine of autonomy of syntax.

The Doctrine of Linguistic Competence

Chomsky formulated the distinction between linguistic competence and linguistic performance in *Aspects of the Theory of Syntax* (1965). Though highly controversial when first presented, it has gradually permeated Cognitive Science; nowadays it is commonplace for cognitive and even developmental psychologists to refer to a particular formulation as a "competence theory," in Chomsky's sense.

We have to be careful about the precise meaning of *competence* and *performance* here, for they are liable to get conflated with common-sense, useful notions (Campbell & Bickhard, 1986). We all recognize that a person may know something, or be able to do something, yet may not manifest this knowledge under some conditions. This distinction—between what the person is competent to do under some condition or another, and how the person manifests that competence under these specific conditions—is not at issue. But we should realize that this common-sense distinction in no way constrains how the skill or knowledge is to be accounted for; it prescribes no specific way of modeling knowledge.

While conducting empirical research in psychology, we may be concerned to sort out the ability of interest to us ("competence") from other abilities ("performance") that are extraneous from our point of view. So, for instance, if I am trying to assess whether a 7-year-old can solve a problem that requires a certain type of reasoning, I would like to be able to exclude memory for the premises as an explanation for the child's performance. Given the purpose of my research, being able to reason in a certain way is "competence," and being able to remember premises beyond a certain length or complexity is "performance."

All the same, what is competence to me may be performance to another researcher; what is an extraneous, confounded nuisance to me may be the primary object of inquiry for someone else. A researcher who wants to track the development of working memory capacity would regard memory for the premises as "competence"; the ability to make that novel inference that so interested me would now become "performance." Again, this second sort of competence-performance distinction in no way dictates how either competence or performance is to be modeled.

Chomsky's distinction is often confused with these other two. It should not be, for it is predicated on very specific

assumptions about the way competence is to be modeled (Campbell & Bickhard, 1986).

Chomsky (1965) distinguishes "linguistic competence," or "knowledge of the language," from the various factors that affect "linguistic performance," such as memory limitations and slips of the tongue. It is not merely limitations and sources of imperfection that are to be regarded as performance factors; "real-time processing" of any sort is performance rather than competence.

To understand precisely what linguistic competence is supposed to mean, let's consider what a Chomskyan linguist actually does. Suppose the linguist's goal is to produce an adequate theory of the syntax of English. The linguist constructs a system of rules that meet the technical requirements of Chomsky's (current) scheme for syntactic analysis. The linguist tests these rules by consulting the "linguistic intuition of the native speaker" (Chomsky, 1965).

For instance, the linguist's current rule system may predict that (1) "It is highly improbable that Bill Clinton will be impeached" and (2) "Bill Clinton is highly improbable to be impeached" are both grammatical sentences in English. However, when asked whether these are good sentences, native speakers of English accept (1) and reject (2). (Chomsky limits the native speaker's sphere of authority to judgments of "acceptability"; the wiggle room this move affords him is not important here). The rule system has identified an ungrammatical sentence as grammatical, so it has failed the empirical test. Consequently, the linguist must modify it so that (1) comes out grammatical and (2) does not. This modified rule system may fail other empirical tests in its turn, and so on.

A rule system that keeps withstanding many such attempts to falsify it is a valuable commodity: if correct, it describes an effectively unbounded range of possible behavior, or possible task accomplishments. It sorts out possible grammatical from possible ungrammatical sentences of English; in many cases, no one has actually said or written any of these sentences. Such a descriptive theory of possible task accomplishments is a powerful device.

But nothing about a *descriptive* theory that correctly sorts out different kinds of possible task accomplishments makes it an adequate *explanatory* theory. Descriptive success does not make it an adequate theory of how those tasks are accomplished.

The central error in Chomsky's (1965) conception of competence is his assumption that a descriptive theory of possible task accomplishments *must* be part of the account that explains how those tasks are accomplished. The error is epitomized in his statement that a theory of the linguistic competence of the native speaker must "incorporate the grammar" of the language.

In Chomsky's subsequent writings on linguistics, any effort not devoted to laying out and defending his latest formalism has been expended on defending this error as an instance of legitimate scientific practice (e.g., Chomsky, 1975, 1980, 1986, 1988). In his defense, Chomsky often resorts to spurious claims about the methods used in the other sciences. For instance, Chomsky (1980) has asserted that if a theory in physics survives empirical tests and meets other desiderata for a good theory, then no one should ever ask whether the entities posited by the theory do have, or could have, "physical reality." In fact, such concerns have been commonplace in physics, in the past and in the present (e.g., Laudan, 1977; Bickhard & Campbell, 1996a). Scientific disciplines are concerned about the ontology of the phenomena they study; psychology *should* be concerned about "psychological reality."

Chomsky's bad philosophy of science aside, his error most often goes unrecognized in the context of linguistic analysis. A linguist endeavors to construct a grammar—for our purposes, this means a descriptive theory of word endings and sentence structure—for Mongolian. Let's assume that the linguist has succeeded at this goal: the rule system he or she has constructed keeps correctly sorting out sentences of Mongolian from non-sentences of Mongolian; it keeps passing the test when assessed against the intuitions of native speakers of Mongolian.

What, then, enables that native speaker to speak Mongolian? What knowledge does he or she use to distinguish good from bad sentences in Mongolian? According to Chomsky, the mature native speaker *knows the very set of rules that the linguist has been laboring to construct and test.* Tacitly, of course; the speaker is not, and cannot be, consciously aware of these rules. But the mature speaker must know the grammar—in Chomsky's current notation, no less!—to be able to speak the language. The learner must be in the process of acquiring that very grammar—again, as expressed in Chomsky's current notation.

Over the years, Chomsky has placed different restrictions on the rule system to be constructed by the linguist; constraints on the form of the rules are driven by a desire for "explanatory" adequacy, as opposed to "descriptive" adequacy. But an "explanatorily" adequate grammar of Mongolian, however motivated by esthetic considerations, or thoughts about "language universals," or anything else, is still a formal description of possible sentences and nonsentences in Mongolian. Even if this grammar of Mongolian has been carefully vetted for what it has in common with formal grammars of English, or Japanese, or Cree, or any other human language, it is still a systematic description of sentences and nonsentences of Mongolian. Yet by virtue of its ability to describe sentences and sort them out from nonsentences, it is supposed to constitute part of the Mongolian speaker's knowledge.

If the jump from an adequate grammar of Mongolian to the Mongolian speaker's knowledge still seems unexceptionable, let's consider a different case. A Major League baseball pitcher (let's say, Greg Maddux of the Atlanta Braves) knows how to throw a sinkerball. Not just any sinkerball, but a sinkerball with pinpoint control, and other properties that tend to get batters out. A physicist seeks to describe this sinkerball in terms of Newtonian mechanics, generating a set of equations that, let's assume, correctly describe the properties of sinkerballs that Maddux throws under different conditions, and do not describe inferior pitches of the sort that Maddux does not throw.

The physicist, then, has arrived at an adequate

theoretical description of Maddux's sinkerball. Quite a feat. Is the physicist thereby entitled to conclude that Maddux must actually *know* the equations in the description, in order to be able to throw the sinkerball thus described?

Obviously, the answer is no. Psychologists may attempt to account for Maddux's skill using various theories of motor control. But none will posit knowledge (tacit or otherwise) of the physicist's Newtonian equations on Maddux's part. Maddux is competent at throwing a sinkerball. He does not therefore have "sinkerball competence."

Similarly, the mature speaker of Mongolian is competent at speaking Mongolian. It does not follow that he or she has "linguistic competence" in Mongolian.

Objections are sometimes made to Chomskyan "competence models" on the grounds that such models predict "ideal," error-free performance. Nothing in Chomskyan "knowledge of the language" makes error possible; extrinsic factors have to be introduced to account for it. These objections are legitimate. Indeed, they cut deeper than is often realized: an error-free system could never learn anything at all (Bickhard & Campbell, 1996b).

The error problem goes much deeper than is usually supposed. Here is another profound problem: the structures that Chomsky has used over the years to describe sentences and distinguish them from nonsentences are all static. They are unsuited by nature to describe processes operating in real time. *But psychology is all about processes operating in real time.* In fact, Bickhard and Terveen (1995) have argued that knowledge of *any* kind requires timing. Chomskyan rules and Chomskyan analyses of sentence structure cannot describe aspects of an agent that is capable of interacting with its environment and meeting its goals in real time; that is to say, Chomskyan sentence structures cannot describe the knowledge, or mental representation, of any agent—except (some of) the knowledge of their type of linguistic analysis that is held by Chomskyan linguists.

Since error is ruled out and nothing describes processes in real time, it matters not at all whether Chomskyan models of "linguistic competence" are notated with NPs and VPs, or V-bars and N-double-bars; whether there are many transformation rules, or one, or none; whether filters are allowed at all, or allowed to proliferate; whether "semantic interpretation" gets done on deep structure, shallow structure, or surface structure; whether the rules are arranged to suit Chomsky's 1957 manner, or his "minimalist" style of the 1990s, or any of the variants in between. *All such models are equally unsuited* to account for the speaker's ability to speak, or comprehend, or tell the difference between good sentences and bad ones.

Though Noam Chomsky has given this fallacy its classic statement, and promoted it more aggressively than anyone else, he is hardly alone in committing it. As Terry Dartnall (1997) has noted, 20th century psychology has frequently fallen prey to "reverse psychologism"; it has continually jumped from linguistic or logical descriptions to theories that put those very same descriptions in the minds of speakers and reasoners. In the psychology of reasoning, the propriety of this leap is subject to debate; not everyone agrees that the formal description of an inference is necessarily resident in the mind of the person who can make that inference (contrast Braine & Rumain, 1983, with Johnson-Laird, 1983). In Chomskyan linguistics, and in the psychological theorizing carried out under its influence, the move is made all the time, and no one objects.

The doctrine of "linguistic competence," then, is already profoundly antipsychological. But the damage it causes has been compounded by another doctrine, this one peculiar to Chomsky.

The Doctrine of Autonomy of Syntax

From the beginning, Chomsky's enterprise has focused primarily on sentence structure. Most efforts in phonology were abandoned a generation ago ("generative phonology" reached its high-water mark with Chomsky and Halle, 1968). And Chomsky has shown little more affinity for semantics than his (officially behavioristic) Bloomfieldian predecessors did (Harris, 1994a, 1994b).

The standard manner of dividing linguistic inquiry, into phonology, syntax, semantics, and pragmatics, is itself untenable on psychological grounds, but the argument for its untenability requires an alternative conception of language (Bickhard, 1980; see also below). At any rate, few linguists have taken these conventional distinctions and reified them with Chomsky's vehemence. By the mid-1970s, Chomsky (e.g., 1975) was proclaiming that syntax is "autonomous." His proclamation meant that the rules and categories of syntax do not depend on anything else within the subject matter of linguistics—specifically, they do not depend in any way on properties of meaning, or of language use. It also meant that the rules of syntax do not depend on any properties of anything *outside* the realm of linguistics. The findings of cognitive psychology may inform us about linguistic meaning, Chomsky (1975) conceded, but they will neither explain nor constrain the rules and structures of syntax.

Since Chomsky believes that knowing how to speak English means knowing the rules of English syntax as notated within his system, knowing how to speak Dyirbal means knowing the rules of Dyirbal as comparably notated, and so on, it follows directly that *knowledge* of syntax is also autonomous. Knowledge of syntax acquires a unique status within the Chomskyan worldview: such knowledge is completely unlike any other knowledge that human beings could have.

The doctrine of the autonomy of syntax was the immediate inspiration for Jerry Fodor's (1983) conception of the human mind as a collection of special-purpose "modules," each equipped with its private stock of unique data structures. (Ironically, however, Fodor was too concerned with accounting for psycholinguistic data to posit a syntax module as such.)

The autonomy doctrine did not inspire Chomsky's insistent nativism regarding language acquisition, which predates it (Chomsky, 1968). But once the autonomy doctrine is accepted, it has the useful property of making this sort of nativism inevitable (e.g., Chomsky, 1975, 1980). If learning to speak a language means coming to know the syntactic rules of that language, precisely as a

Chomskyan linguist would notate them (the linguistic competence doctrine), and knowledge of those syntactic rules is completely unlike any other knowledge we could ever acquire (the autonomy doctrine), then human beings must all come equipped with at least a skeletal set of syntactic rules. Otherwise we could never acquire the rules of our native language, and could never "learn" to speak it grammatically. In the 1980s, Chomsky's brand of nativism acquired its now familiar form of asserting that newborn babies arrive with an encoded Universal Grammar. All that has to be done, then, to attain the syntactic rules of the language being learned is to set approximately 100 parameters, thereby fleshing out these skeletal rules (Chomsky, 1986, 1988; Pinker, 1994).

Innateness claims are not problematic *per se*. Human beings are clearly preadapted to learn spoken (or signed) language, in ways that we are not preadapted to learn to read. The obstacles are the *sort* of innate knowledge Chomsky is positing, and the *grounds* for insisting that it must be innate.

Normally, if we posit innate skills, knowledge, or tendencies in human beings, or organisms of other species, we are emitting a promissory note. We may not have an evolutionary account of the origin of these abilities ready to hand, but if our account of innate knowledge is tenable, there must be some way in which this knowledge came into being through the processes of evolutionary variation and selection.

But Chomskyan nativism emits no such promissory notes; it declares that none can be tendered. If knowledge of syntax is so much unlike knowledge of anything else that it could not have come into being during the early years of individual human beings, how could it have come into being during eons of evolution? Well before Chomsky (1988) affirmed in print that human language capabilities could not be a product of natural selection, this anti-evolutionary conclusion was inescapable, given his doctrines of linguistic competence and syntactic autonomy.

As Chomsky's anti-evolutionary proclivities have become more widely recognized, some of his disciples have sought to distance themselves from his views. They have diagnosed Chomsky's anti-evolutionism as a misunderstanding of neo-Darwinism, or a theological quirk, unrelated to the substance of his linguistic theories.

Dennett (1995) accepts all of Chomsky's strictures regarding syntax, including the supposed proof that babies are born with innate knowledge of the rules of Universal Grammar, then takes Chomsky to task for his resistance to neo-Darwinian evolutionary explanations.

Pinker (1994) promotes a strongly Chomskyan conception of language and of language development—along with related doctrines, such as Fodorian modularity—while affirming that human language arose through selection pressures on our ancestors' means of communicating with their conspecifics. In taking this way out, Pinker is required to dismiss Chomsky's (1975) assertion that human language is not primarily a means of communication—despite the evident irrelevance of Chomsky's syntactic descriptions to any account of communicative activity. Like Dennett, Pinker fails to grasp the consequences of the doctrines of competence and syntactic autonomy, both of which he continues to accept.

Chomsky, then, is being consistent when he digs in his heels and refuses to go where Darwin might lead him; his followers are being inconsistent when they seek to harness his linguistic theories to a neo-Darwinian account of cognitive evolution.

Chomsky is consistent, but that does not mean that he is right. Chomskyan linguistics tells us that some kinds of knowledge (specifically, syntactic knowledge) cannot develop. Worse yet, it tells us that they cannot evolve, that they are evolution-proof. But if a conception of knowledge makes it impossible for that knowledge to come into being, that conception is untenable. Knowledge of language did not exist back when life forms were just emerging out of the primordial soup, but it does exist now—so it must have emerged at some time in between.

Chomsky's own anti-evolutionary arguments are not the most philosophically interesting ones. His case for the autonomy of syntax moves in a tight circle:

"(1) Syntax is autonomous. Its primitive concepts are irreducible to, and distinct from, those of semantics, cognitive science, or anything else.

(2) Therefore, only the most abstract syntactic inputs can be relevant to the learning of syntax. Context, meaning, intrinsic developmental constraints, and so on, are ruled out a priori.

(3) Given his austere construal of the language learning problem, Chomsky concludes that the 'available information' is insufficient to specify the grammar of the language being learned within the space of abstractly possible grammars.

(4) Because of the lack of available information, he concludes that there must be an innate syntax-learning faculty or organ. Otherwise the task of learning syntax would be impossible.

(5) The dedicated innate syntax-learning faculty constitutes further confirmation that syntax is autonomous." (Campbell & Bickhard, 1992, pp. 581-582)

When not repeating his circular argument, Chomsky has sought to throw his opponents off balance, challenging them to produce on the spot an explanation of some arcane detail of his current formal scheme for syntax. Such tactics may be effective in the heat of debate (as they were in Piattelli-Palmarini, 1980). Upon reflection, however, those who hold rival conceptions of language may realize that they do not recognize such properties, in which case they are under no obligation to explain them. In other cases, explanations for the patterns and constraints of interest to Chomsky may be readily available from non-syntactic sources (see Bickhard, 1995, for a non-Chomskyan account of the supposedly unique syntactic constraints in Chomsky's government and binding theory).

Chomsky's longtime philosophical ally Jerry Fodor (e.g., 1981) is just as anti-evolutionary, but his views pertain to human knowledge in general, instead of being restricted to purported knowledge of syntactic rules. And Fodor normally relies on arguments in principle. Consequently, there is much more to be learned from the critical analysis of his doctrines than from the critical analysis of Chomsky's (Campbell & Bickhard, 1981; Bickhard, 1991, 1993).

Still, it is Chomsky's ideas that have dominated American linguistics for nearly 40 years. It is Chomskyan linguistics with which psychology vainly attempts to coexist. It is Chomskyan linguistics that has stubbornly failed to integrate with the other disciplines that have coalesced into Cognitive Science.

The Fate of Linguistics

Over time, some members of the Cognitive Science community have learned to ignore Chomskyan linguistics, or to work around it. Following Schank (1975), many researchers in Natural Language Processing have rejected Chomsky's system as irrelevant to their enterprise, particularly because of its failure to deal with meaning. But many others in Cognitive Science continue to rely in vain on this intractable set of doctrines. There are developmental psychologists who, in essence, deny that development occurs. Under Chomskyan influence, they have concluded that the most important kinds of human knowledge, like knowledge of syntax, cannot come into being through learning.

Formal linguistics is an ancient discipline (Robins, 1967), nearly as ancient as Western philosophy, and far older than psychology. In the work of Chomsky and his school, traditional linguistics has finally and fatally overreached itself. It has ventured too far beyond the limits imposed by treating sounds and word parts and words and sentences as "linguistic objects," then subjecting such objects to formal analysis. (The institutional morbidity of American linguistics—even wealthy, prestigious universities have been closing their Linguistics Departments—seems to track its conceptual crisis.)

Old-fashioned formal linguistics may not disappear; it may continue to assist us in gaining metalinguistic awareness, in learning more about the properties of the language we speak and gaining control over some of them. It may endure, in other words, carrying out the functions that 20th century linguists have come to despise as "school grammar."

But for those of us who need to understand language from a psychological (or sociological, or neurological, or AI) standpoint, there is no doubt that massive retooling will be required. Whether the new accounts that we need will be called "linguistics," or something else, is not settled. What they will do with all of the conventional linguistic phenomena—subjects and predicates, genitives and datives, Noun Phrases and Verb Phrases, infinitives and complements—is not yet clear; some of the classic phenomena may be discarded, others retained, still others thoroughly reinterpreted. Some linguistic formalisms may be able to contribute to a thoroughly process-oriented account; other aspects of language use, particularly those that require variation and selection within the immediate context, may prove recalcitrant to any currently available formalism (Campbell & Bickhard, 1992).

I offer my suggestions about alternative conceptions of language with some trepidation. No one has less patience with programmatic alternatives than a formal linguist. And one page of camera-ready copy not enough to specify a programmatic alternative. (A far more elaborated presentation would still fail to satisfy the noted Chomskyan who refused to read any critique of his position—unless it was book-length.)

Still, some guidelines can be put forward.

A psychologically adequate account of language must begin with an adequate account of *knowledge.* Not because knowledge and language should be conflated, as they are in so many contemporary approaches. Rather, an adequate account begins with a conception of knowledge as *interactive,* as an emergent property of a system that is capable of interacting with its environment, not a conception of knowledge as structures in the mind that correspond to structures out in the environment. It is the persistence of inadequate views about knowledge that makes Chomsky's competence doctrine and other instances of "reverse psychologism" so attractive; if knowledge consists of structures in the mind that are isomorphic to structures in the environment, what could be wrong with putting the structures of formal grammar or formal logic back into the mind of the speaker or reasoner?

But if knowledge is not fundamentally encoded, or constituted by structural correspondence between mental representations and things in the environment, then language cannot be a system for recoding the speaker's encoded knowledge into utterances, which are then decoded into encoded knowledge by a listener. (Because they retain traditional views of knowledge as encoded, and of language as a system for transmitting encoded knowledge, standard critiques of Chomsky within Cognitive Science [e.g., Schank, 1975] fail to identify all of Chomsky's incorrect presuppositions—nor have they arrived at an alternative view of language that avoids these presuppositions.)

If knowledge is interactive, it usually will not take the form required for recoding, transmission, and decoding, so language will have to be understood in a different way. Bickhard (1980) has argued that language is an advanced communicative action system, whose evolution can be understood in terms of the evolution of communicative action systems. In Bickhard's approach, utterances are operators on understandings (or "situation conventions") that are shared among the agents who are doing the communicating; sentences are operator forms. Sentence structure is a matter of differentiations made within whole communicative acts, not of well-formed encodings; and the conventional distinction between semantics and pragmatics collapses, because the conventional distinction can no longer be drawn between those aspects of language that pertain to truth and falsity and those that pertain to the uses that can be made of language. Operator forms are used to bring about changes in situation conventions, and it is the situation conventions, not the operator forms, that can be true or false.

Some existing linguistic theories have resources to offer us as we embark on this quest. Besides such obvious candidates (for a Cognitive Science audience) as Speech Act theory (Searle, 1969) and categorial grammar (discussed in Bickhard & Campbell, 1992), there are others, little known in the USA, that have insights to offer: for instance, functionalism of the Prague school (Sgall, Hajicová, &

Panevová, 1986) and of the London school (Halliday, 1975), and utterer-centered linguistics (Culioli, 1990).

These conceptions and still others have strengths and weaknesses that deserve a much more detailed treatment. Indeed, most have received such a treatment elsewhere (Bickhard, 1980; Bickhard & Campbell, 1992; Campbell & Bickhard, 1992; Bickhard & Terveen, 1995). But no positive guidance will be forthcoming from the Chomskyan school as we seek a psychologically relevant account of human language.

That is not to belittle Chomsky's significance. After his arguments in principle against behaviorism, Chomsky's major accomplishment was to push old-fashioned linguistics beyond its limits. He has established once and for all that old-fashioned linguistic analysis cannot tell us what the mature speaker of a language knows, or what the language learner is learning. These are valuable and hard-won lessons.

References

Bickhard, M. H. (1980). *Cognition, convention, and communication.* New York: Praeger.

Bickhard, M. H. (1991). The import of Fodor's anticonstructivist argument. In L. P. Steffe (Ed.), *Epistemological foundations of mathematical experience.* New York: Springer.

Bickhard, M. H. (1993). Representational content in humans and machines. *Journal of Experimental and Theoretical Artificial Intelligence, 5,* 285-333.

Bickhard, M. H. (1995). Intrinsic constraints on language: Grammar and hermeneutics. *Journal of Pragmatics, 23,* 541-554.

Bickhard, M. H., & Campbell, R. L. (1992). Some foundational questions concerning language studies: With a focus on categorial grammars and model-theoretic possible worlds semantics. *Journal of Pragmatics, 17,* 401-433.

Bickhard, M. H., & Campbell, R. L. (1996a). Developmental aspects of expertise: Rationality and generalization. *Journal of Experimental and Theoretical Artificial Intelligence, 8,* 399-417.

Bickhard, M. H., & Campbell, R. L. (1996b). Topologies of learning and development. *New Ideas in Psychology, 14,* 111-156.

Bickhard, M. H., & Terveen, L. (1995). *Foundational issues in Artificial Intelligence and Cognitive Science—Impasse and solution.* Amsterdam: North-Holland.

Braine, M. D. S, & Rumain, B. (1983). Logical reasoning. In J. H. Flavell & E. M. Markman (Eds.), *Handbook of child psychology, Vol. III: Cognitive development.* New York: Wiley.

Campbell, R. L., & Bickhard, M. H. (1986). *Knowing levels and developmental stages.* Basel: S. Karger.

Campbell, R. L., & Bickhard, M. H. (1987). A deconstruction of Fodor's anticonstructivism. *Human Development, 30,* 48-59.

Campbell, R. L., & Bickhard, M. H. (1992). Clearing the ground: Foundational questions once again. *Journal of Pragmatics, 17,* 557-602.

Chomsky, N. (1965). *Aspects of the theory of syntax.* Cambridge, MA: MIT Press.

Chomsky, N. (1968). *Language and mind.* New York: Harcourt Brace & World.

Chomsky, N. (1975). *Reflections on language.* New York: Pantheon.

Chomsky, N. (1980). *Rules and representations.* New York: Columbia University Press.

Chomsky, N. (1986). *Knowledge of language: Its nature, origin, and use.* New York: Praeger.

Chomsky, N. (1988). *Language and problems of knowledge: The Managua lectures.* Cambridge, MA: MIT Press.

Chomsky, N., & Halle, M. (1968). *The sound pattern of English.* New York: Harper & Row.

Culioli, A. (1990). *Pour une linguistique de l'énonciation, Vol 1: Opérations et représentations.* Gap, France: Ophrys.

Dartnall, T. (1997). What's psychological and what's not: The act/content confusion in Cognitive Science, Artificial Intelligence, and linguistic theory. In S. O'Nuallain, P. McKevitt, & E. MacAogain (Eds.), *Two sciences of mind: Readings in Cognitive Science and consciousness.* Philadelphia: Benjamins.

Dennett, D. C. (1995). *Darwin's dangerous idea: Evolution and the meanings of life.* New York: Simon & Schuster.

Fodor, J. A. (1981). The present status of the innateness controversy. In J. A. Fodor (Ed.), *RePresenations.* Cambridge, MA: MIT Press.

Fodor, J. A. (1983). *The modularity of mind: An essay on faculty psychology.* Cambridge, MA: MIT Press.

Halliday, M. A. K. (1975). *Learning how to mean: Explorations in the development of language.* London: Edward Arnold.

Harris, R. A. (1994a). The Chomskyan revolution I: Syntax, semantics, and science. *Perspectives on Science, 2,* 38-75.

Harris, R. A. (1994b). The Chomskyan revolution II: Sturm und Drang. *Perspectives on Science, 2,* 176-230.

Johnson-Laird, P. H. (1983). *Mental models.* Cambridge, MA: Harvard University Press.

Laudan, L. (1977). *Progress and its problems.* Berkeley: University of California Press.

Piattelli-Palmarini, M. (1980). *Language and learning: The debate between Jean Piaget and Noam Chomsky.* Cambridge, MA: Harvard University Press.

Pinker, S. (1994). *The language instinct.* New York: Morrow.

Robins, R. H. (1967). *A short history of linguistics.* Bloomington: Indiana University Press.

Schank, R. C. (1975). *Conceptual information processing.* Amsterdam: North-Holland.

Searle, J. (1969). *Speech acts.* Cambridge: Cambridge University Press.

Sgall, P., Hajicová, E., & Panevová, J. (1986). *The meaning of the sentence in its semantic and pragmatic aspects.* Dordrecht: Reidel.